Savannah River Plant

Aiken, South Carolina
Region 4
SC1890008989

Site Exposure Potential

The Savannah River Plant is located in Aiken, South Carolina near the Georgia border (Figure 1). The plant, operated by the U.S. Department of Energy since 1954 with the assistance of numerous contractors, produces nuclear materials for national defense purposes. Currently, there are four active reactor areas. There are extensive current and historical sources of contamination at the site, including both sources of conventional and radioactive contaminants. Pits were used for disposal of chemical wastes, including unlined earthen pits that received dilute sulfuric acid and sodium hydroxide. Paper, wood, plastics, rubber, oil, degreasers, and solvents contained in drums were incinerated in burning and rubble pits. Some basins that collected runoff from coal piles were also used for disposal of contaminated oil. Storage tanks were used for chemicals, feed, and water. Petroleum products were stored in underground tanks (Westinghouse 1989).

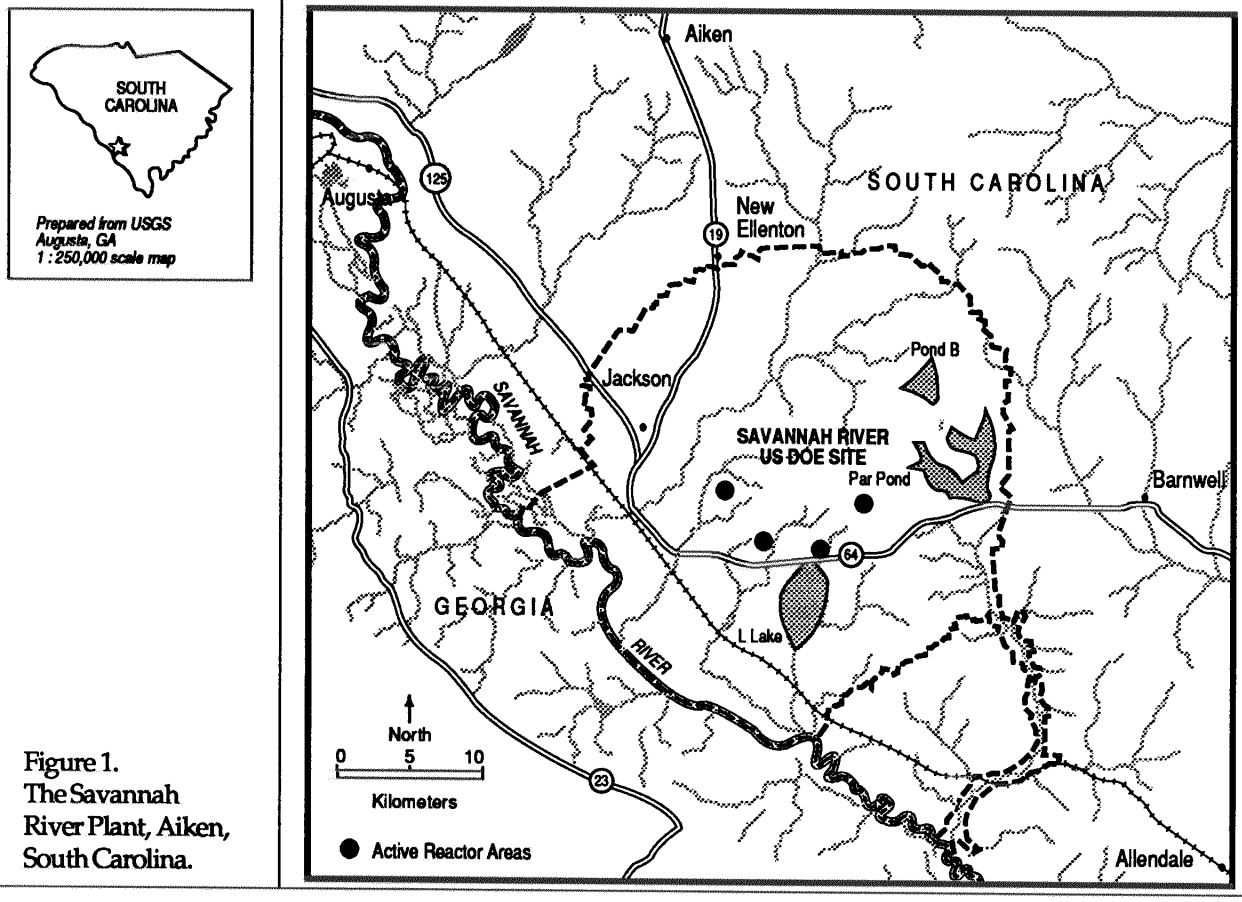

Figure 1.
The Savannah River Plant, Aiken, South Carolina.

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Site Exposure Potential, *cont.*

Other sources include an unlined sludge lagoon, land areas where sludge was applied, and sanitary landfills. Sources of radioactive contamination include burial grounds for radioactive wastes, buried debris from an exploded evaporator, and a sump for high-level radioactive sludge. Other areas include concrete-lined disassembly basins that contain water used to store irradiated parts from reactors, basins that received radioactive purge water from these disassembly basins, and a building where target rods from nuclear reactors are dissolved using nitric acid. Contaminants emitted into the atmosphere include tritium and 1,1,1-trichloroethane.

The site covers approximately 780 km^2 and is bordered on the south by the Savannah River. There are extensive wetlands along the Savannah River and its numerous tributaries. Manmade lakes on the site include Pond B, L-Lake, and the 1,060-hectare Par Pond. Surface geology is characterized by unconsolidated sand, clayey sand, and sandy clay, underlain by dense crystalline metamorphic rock or consolidated red mudstone. Groundwater on the site flows generally towards the Savannah River or its tributaries.

Site activities have potentially contaminated soil, groundwater, surface water, and sediment. Because of the geography and geology of the site, surface water runoff and groundwater transport represent the primary pathways for transport of contaminants to the Savannah River.

Site-Related Contamination

The only contaminant data for soils presented in the 1988 Savannah River Environmental Report were those from radiological monitoring. Groundwater was contaminated by metals throughout the site. Sediment samples were tested for PCBs and pesticides only (Westinghouse 1989).

Radionuclides and trichloroethylene were found in groundwater throughout the site. Other organic contaminants were also measured, including carbon tetrachloride, benzene, 1,2-dichloroethane and 1,1-dichloroethylene, but there are no screening levels available for these compounds (Westinghouse 1989). Maximum concentrations of metals found in waters and sediments at the site are shown in Table 1, along with appropriate screening levels (Westinghouse 1989).

Site-Related Contamination, *cont.*

Table 1. Maximum concentrations of major contaminants in groundwater, surface water, and sediment collected at the Savannah River site.

	Water			Sediment	
	Ground-water µg/l	Surface Water µg/l	AWQC[1] µg/l	Sediment mg/kg	ER-L[2] mg/kg
INORGANIC SUBSTANCES					
cadmium	113	< 10	1.1+	NT	5
chromium	854	< 20	11	NT	80
copper	2,040	20	12+	NT	70
iron	803,000	1,500	1,000	NT	NA
lead	3,600	60	3.2+	NT	35
mercury	19.3	0.83	0.012	NT	0.15
nickel	1,420	< 5	160+	NT	30
silver	66	ND	0.12	NT	1
zinc	7,300	30	110+	NT	120
ORGANIC COMPOUNDS					
DDT	ND	< 0.05	0.001	< 2	0.003
endrin	12.6	< 0.05	NA	< 2	0.00002
PCB 1260	ND	< 0.50	0.014*	< 20	0.03

1: Ambient water quality criteria for the protection of aquatic organisms. Freshwater chronic criteria presented (EPA 1986)
2: Effective range-low; the concentration representing the lowest 10 percentile value for the data in which effects were observed or predicted in studies compiled by Long and Morgan (1990).
\+ Hardness-dependent criteria; 100 mg/l $CaCO_3$ used.
NT Not tested
* Value shown is for total PCB
ND Not detected at method detection limit, detection limit not available
NA Screening level not available

Radioactivity is monitored in rainfall, soil, and sediment; and in tissues of fish, invertebrates, and hogs and deer. The maximum concentration of non-volatile beta radioactivity in fish was measured in bass at 162 pCi/g in Pond B. In comparison, the maximum concentration measured in bass at the mouth of the Savannah River was 1.8 pCi/g. The maximum concentration of cesium-137 in fish (145 pCi/g) was found in bass in Pond B, compared to concentrations of 0.10 pCi/g in bass from the mouth of the Savannah River (Westinghouse 1989). Soil data were not presented, but cesium-137 concentrations were discussed as ranging from 0.14 to 1.1 pCi/g (Westinghouse 1989). Table 2 compares maximum concentrations of radionuclides and trichloroethylene to EPA drinking water standards (Westinghouse 1989).

Table 2. Maximum groundwater concentrations for radionuclides and trichloroethylene at the site compared to EPA drinking water standards.

Contaminant	Units	Maximum Concentration	Drinking Water Standard*
gross alpha	pCi/l	2,140	15
total radium	pCi/l	140	5
radium 226	pCi/ml	1.52	0.005
tritium	pCi/ml	3,480,000	20
trichloroethylene	mg/l	128	0.005

*U.S.Government Printing Office 1987

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NOAA Trust Habitats and Species

The habitat of concern to NOAA is the Savannah River, which borders the site for approximately 48 km, beginning at river km 233. The river bordering the site is fresh water, and provides habitat for several spawning runs of andromous species, including the federally and state endangered shortnose sturgeon (Table 3; Oakley personal communication 1990). The anadromous species listed in Table 3 all spawn within the portion of the river bordered by the site.

Table 3. Species and habitat use in the Savannah River near the site.

Species		Habitat		
Common Name	Scientific Name	Spawning	Nursery	Adult Forage
ANADROMOUS/CATADROMOUS FISH				
shortnose sturgeon	*Acipenser brevirostris*	◆	◆	◆
Atlantic sturgeon	*Acipenser oxyrhynchus oxyrhynchus*	◆	◆	◆
blueback herring	*Alosa aestivalis*	◆	◆	◆
hickory shad	*Alosa mediocris*	◆	◆	◆
American shad	*Alosa sapidissima*	◆	◆	◆
American eel	*Anguilla rostrata*		◆	
striped bass	*Morone saxatilis*	◆	◆	◆
ESTUARINE FISH				
striped mullet	*Mugil cephalus*		◆	◆

The Savannah River is heavily polluted, particularly from sewage from the city of Augusta, upstream of the site (Oakley personal communication 1990).

Amercian shad are commercially fished in the river during the summer months. Both Atlantic and shortnose sturgeon spawn near the site, and juveniles spend from one year to 18 months in the river before migrating downstream to the estuary at the river mouth. To augment the natural population of shortnose sturgeon, the South Carolina Marine Resources Division stocks the river with juveniles that were raised in hatcheries. Atlantic sturgeon were previously fished in the river, but fishing has been restricted for about five years. Striped bass are fished recreationally in the river from the South Carolina side, but fishing is restricted by the state of Georgia (Oakley personal communication 1990).

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NOAA Habitats and Species, *cont.*

The estuary at the mouth of the Savannah River is a major nursery area for marine species, including summer flounder, spot, Atlantic menhaden, croaker, tarpon, and blue crab.

References

Long, E.R., and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program. Seattle: Coastal and Estuarine Assessment Branch, NOAA. NOAA Technical Memorandum NOS OMA-52. 175 pp.+ Appendices.

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